

# LIVINGSTON CANDIDATE WIND TURBINE SITE

## PARK COUNTY

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The Livingston Candidate Wind Turbine site is located approximately 2 miles northeast of Livingston, and just east of the old airport, at 45 40 27 N and 110 30 01 W (Site No. 95 on Map II-1). Elevation at the site is 4,658 feet.

The site is located in the Yellowstone River Valley just north of the Absaroka Mountains. Most of the land in the valley is privately owned, although there are a few sections of publicly owned land in the region. Much of the privately owned land has been leased for wind energy use. Land in the mountains is controlled predominantly by the U.S. Forest Service. Electrical service in the area is provided by the Montana Power Company and by the Park Electric Cooperative. The only commercial airport in the area is 4 miles northeast of the site.

This site was established by the U.S. Department of Energy as part of a federal wind energy program. The intent of the program was to provide information on wind characteristics to those involved in the design, evaluation, and operation of wind energy systems. The Bonneville Power Administration assumed responsibility for operating the site in October 1982 through June 1983. Little data were recovered during that period because of equipment failures. Montana DNRC in 1986 resumed monitoring at this site in a study of wind shear.

Wind data from September 1, 1980, through June 30, 1982, were available for analysis. The data set consists of hourly averages of wind speed and wind direction at three heights: 9.1, 30.0, and 45.7 meters above ground level. Data recovery ranged from 49.2 percent in May to 99.5 percent in October. Overall data recovery at 9.1 meters was 78.8 percent. The percentage of data recovery was different at the different levels. (BPA is gathering data only at 15.2 meters and 45.7 meters.)

This monitoring period was long enough to adequately represent the wind resource at the location. Because the terrain in the area is complex, the data are representative only of a limited area in the Yellowstone River Valley near Livingston.

At 9.1 meters above ground level, average annual wind speed was 15.6 miles per hour. Average monthly wind speeds ranged from 9.5 miles per hour in August to 23.3 miles per hour in December. Average annual wind power at this height was 494.4 watts/m<sup>2</sup>. Average monthly wind power varied from 95.1 watts/m<sup>2</sup> in August to 1,260.1 watts/m<sup>2</sup> in December. (The average speed and power for February may be low, due to malfunctioning equipment.)

At 30 meters above ground level, the average annual wind speed was 18.1 miles per hour. Average monthly wind speeds at this height ranged from 11.1 miles per hour in August to 26.2 miles per hour in December. Average annual wind power at this height was 738.4 watts/m<sup>2</sup>. Average monthly wind power varied from 150.0 watts/m<sup>2</sup> in August to 1760.2 watts/m<sup>2</sup> in December.

At 45.7 meters above ground level, average annual wind speed was 19.5 miles per hour. Average monthly wind speeds ranged from 13.2 miles per hour in August to 27.4 miles per hour in December. Average annual wind power at this height was 876.4 watts/m<sup>2</sup>. Average monthly wind power ranged from 196.3 watts/m<sup>2</sup> in August to 2,101.7 watts/m<sup>2</sup> in February.

Average seasonal wind speeds at 9.1 meters were 11.2 miles per hour in summer, 12.8 miles per hour in spring, 15.4 miles per hour in autumn, and 20.8 miles per hour in winter.

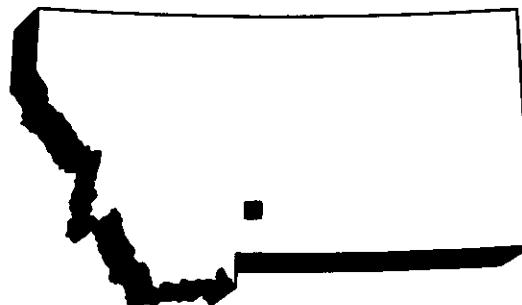


Table IV - 116

## Monthly Wind Speed Distribution

## PARK COUNTY - LIVINGSTON CANDIDATE WIND TURBINE SITE

09/01/80 - 06/30/82

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR	
CALM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	CALM
0.1-1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1-0.4
1.1-2.0	1.0	11.5	4.1	1.3	0.5	0.4	0.4	1.4	0.3	0.0	0.3	0.1	1.8	0.5-0.9
2.1-3.0	2.5	1.3	3.7	4.5	3.1	3.3	2.6	6.4	4.8	2.2	3.5	1.3	3.1	1.0-1.3
3.1-4.0	5.8	2.5	6.7	5.8	7.2	5.0	8.3	10.5	8.4	5.4	3.2	2.0	5.5	1.4-1.8
4.1-5.0	4.9	2.9	7.0	5.2	7.9	8.5	7.7	10.6	6.8	5.3	2.9	2.4	5.6	1.9-2.2
5.1-6.0	4.8	1.2	4.2	4.7	8.2	7.7	8.2	8.3	8.0	6.2	2.2	3.2	5.2	2.3-2.7
6.1-7.0	3.8	1.7	4.9	4.7	6.8	6.1	5.6	7.6	7.1	4.4	1.9	2.1	4.4	2.8-3.1
7.1-8.0	1.9	2.6	6.5	4.1	8.9	5.2	5.6	5.3	4.9	4.1	2.8	2.8	4.3	3.2-3.6
8.1-9.0	4.3	1.2	3.9	3.8	6.3	5.4	5.2	6.0	3.9	3.6	2.0	2.9	3.8	3.7-4.0
9.1-10.0	2.1	2.0	4.8	3.6	3.7	5.8	5.7	4.9	5.0	3.3	2.1	2.7	3.6	4.1-4.5
10.1-11.0	2.9	1.6	3.8	2.7	4.6	5.7	3.4	3.9	5.1	4.5	3.1	1.5	3.5	4.6-4.9
11.1-12.0	2.7	2.2	3.6	2.7	4.6	5.3	4.2	4.2	5.3	4.2	2.9	2.5	3.6	5.0-5.4
12.1-13.0	3.1	2.7	3.8	2.4	4.0	3.6	3.3	4.8	5.6	3.2	4.0	2.7	3.6	5.5-5.8
/ 13.1-14.0	4.1	2.2	2.8	2.7	3.4	3.3	2.3	3.7	4.8	3.2	3.7	2.7	3.3	5.9-6.3
H 14.1-15.0	4.6	2.0	4.7	4.2	2.6	3.9	3.3	2.4	4.2	4.3	3.6	2.7	3.6	6.4-6.7
O 15.1-16.0	3.5	1.5	2.8	4.0	4.2	3.0	3.1	2.2	3.3	2.9	2.6	3.3	3.0	6.8-7.2
U 16.1-17.0	3.3	2.6	2.9	3.8	3.1	3.9	5.6	3.8	3.4	4.2	3.1	2.8	3.5	7.3-7.6
R 17.1-18.0	3.2	2.7	2.9	4.5	3.1	3.2	3.7	2.6	2.5	3.4	3.7	3.0	3.2	7.7-8.0
18.1-19.0	3.2	2.2	3.0	3.7	2.6	3.6	4.3	3.1	2.8	3.3	4.7	2.2	3.2	8.1-8.5
19.1-20.0	3.3	3.2	2.7	4.4	3.1	3.5	4.3	2.2	1.8	3.8	3.8	3.0	3.2	8.6-8.9
20.1-25.0	11.1	12.1	13.5	13.2	9.7	8.6	9.4	4.5	7.1	14.7	15.5	11.8	11.3	9.0-11.2
25.1-30.0	9.1	9.6	4.9	6.9	2.0	2.8	2.7	1.8	3.3	8.8	12.1	10.8	6.9	11.3-13.4
30.1-35.0	4.4	10.7	1.9	4.6	0.0	1.4	0.4	0.0	1.1	2.7	7.6	9.9	4.3	13.5-15.6
35.1-40.0	3.0	8.9	1.1	1.5	0.0	0.4	0.7	0.0	0.7	1.4	5.2	9.4	3.2	15.7-17.9
>40.0	7.4	8.9	0.0	0.9	0.0	0.0	0.1	0.0	0.0	1.0	3.5	12.3	3.4	>17.9
AVERAGE SPEED (MPH)	17.7	20.7	12.6	14.8	11.0	11.8	11.9	9.5	11.3	15.1	19.3	23.3	15.6	
AVERAGE SPEED (M/SEC)	7.9	9.3	5.7	6.6	4.9	5.3	5.3	4.3	5.1	6.7	8.6	10.4	7.0	
AVERAGE WIND POWER (WATTS/M**2)	733.9	1044.5	241.0	364.6	132.4	171.8	176.1	95.1	160.5	358.3	1095.8	1260.1	494.4	
PERCENT DATA RECOVERY	70.7	89.4	63.3	54.2	49.2	69.2	98.9	98.9	84.7	99.5	97.6	91.1	78.8	

ANEMOMETER HEIGHT = 9.1 METERS = 30 FEET

NUMBER OF OBSERVATIONS = 12638

PERCENTAGE DATA RECOVERY = 78.8

SOURCE: GEORESEARCH, INC.

**Table IV - 117**  
**Monthly Average Wind Speed and Wind Power Density (30 Meters)**  
**PARK COUNTY - LIVINGSTON CANDIDATE WIND TURBINE SITE**

**09/01/80 - 06/30/82**

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
AVERAGE SPEED (MPH)	20.0	25.4	19.2	16.7	12.1	13.6	13.8	11.1	13.0	17.3	22.4	26.2	18.1
AVERAGE SPEED (M/SEC)	8.9	11.3	8.6	7.5	5.4	6.1	6.2	5.0	5.8	7.7	10.0	11.7	8.1
AVERAGE WIND POWER (WATTS/M**3)	984.3	1740.4	739.2	512.2	180.3	254.5	267.7	150.0	245.7	526.3	1059.5	1760.2	738.4
PERCENT DATA RECOVERY	70.6	75.4	54.8	54.2	49.1	69.0	98.8	98.9	84.6	98.8	94.3	80.4	75.5

SOURCE: GEORESEARCH, INC.

**Table IV - 118**  
**Monthly Average Wind Speed and Wind Power Density (45.7 Meters)**  
**PARK COUNTY - LIVINGSTON CANDIDATE WIND TURBINE SITE**

**09/01/80 - 06/30/82**

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
AVERAGE SPEED (MPH)	22.7	26.5	20.5	18.2	14.4	15.3	15.7	13.2	14.7	19.0	22.8	27.4	19.5
AVERAGE SPEED (M/SEC)	10.2	11.9	9.2	8.1	6.4	6.8	7.0	5.9	6.6	8.5	10.2	12.2	8.7
AVERAGE WIND POWER (WATTS/M**3)	1592.4	2101.7	916.4	601.7	243.1	323.3	328.4	196.3	309.9	670.4	1068.9	2077.9	876.4
PERCENT DATA RECOVERY	45.7	71.4	55.2	54.3	49.2	69.2	98.9	98.9	84.7	99.4	83.9	77.8	71.8

SOURCE: GEORESEARCH, INC.

Table IV - 119

## Percentage Frequency Summary for Wind Speed

**PARK COUNTY - LIVINGSTON CANDIDATE WIND TURBINE SITE  
(WINTER)**

09/01/80 - 06/30/82

	CALM	WIND SPEED (MPH)																	AV SPEED (MPH)	AV SPEED (M/SEC)	
		WIND SPEED (METERS/SECOND)																			
		0.1-0.9	0.9-1.8	1.8-2.7	2.7-3.6	3.6-4.5	4.5-5.4	5.4-6.3	6.3-7.2	7.2-8.0	8.1-8.9	9.0-11.2	11.2-13.4	13.5-15.6	15.7-17.9	>17.9					
1	0.0	4.6	5.9	9.2	5.2	5.2	3.9	5.9	6.5	6.5	3.9	11.8	5.2	9.8	3.9	12.4	19.8	8.8			
2	0.0	4.0	5.4	8.7	4.0	5.4	4.7	7.4	6.7	4.0	4.7	10.7	6.7	10.7	6.7	10.1	20.4	9.1			
3	0.0	2.6	5.3	6.6	4.6	5.3	6.6	4.6	7.3	4.0	7.9	11.3	7.3	7.9	9.9	8.6	20.8	9.3			
4	0.0	4.0	3.3	7.3	2.7	4.7	3.3	6.7	9.3	6.7	6.0	12.0	7.3	9.3	7.3	10.0	21.0	9.4			
5	0.0	3.3	4.0	6.0	5.3	5.3	4.7	4.7	3.3	9.3	6.7	12.0	9.3	8.7	6.7	10.7	21.2	9.5			
6	0.0	2.7	4.7	6.1	3.4	7.4	4.1	5.4	5.4	4.7	4.7	12.8	10.8	7.4	8.1	12.2	21.6	9.6			
7	0.0	3.4	3.4	7.4	6.7	4.7	2.7	5.4	4.0	6.7	2.7	9.4	16.8	8.1	8.1	10.7	22.0	9.8			
8	0.0	3.4	5.4	4.0	6.7	2.7	6.7	4.0	5.4	4.0	5.4	10.7	10.7	9.4	8.1	13.4	22.5	10.1			
H	9	0.0	3.4	5.4	3.4	6.0	4.7	4.0	3.4	6.0	5.4	2.7	10.7	15.4	9.4	8.1	12.1	23.0	10.3		
O	10	0.0	4.7	4.0	3.4	3.4	5.4	4.0	4.0	6.7	4.7	3.4	8.7	15.4	10.7	8.1	13.4	23.4	10.5		
U	11	0.0	4.1	3.4	4.1	5.4	4.1	3.4	6.1	4.7	3.4	5.4	8.1	14.9	9.5	8.1	15.5	23.8	10.6		
R	12	0.0	6.1	4.8	5.4	3.4	2.7	2.7	4.8	4.8	4.8	4.8	9.5	12.9	11.6	8.2	13.6	22.8	10.2		
	13	0.0	5.4	2.0	6.8	4.1	3.4	4.1	4.1	3.4	3.4	6.1	14.9	10.8	9.5	13.5	8.8	22.6	10.1		
	14	0.0	5.4	1.3	6.7	5.4	4.0	4.7	5.4	2.0	5.4	6.0	14.8	15.4	8.7	7.4	21.2	9.5			
	15	0.0	5.3	3.9	5.3	3.9	5.3	2.6	6.6	3.3	5.9	8.6	19.7	7.2	6.6	7.2	8.6	20.4	9.1		
	16	0.0	5.9	4.6	2.6	3.9	2.6	7.2	4.6	7.2	8.5	7.8	15.7	5.9	11.8	5.9	5.9	20.1	9.0		
	17	0.0	5.2	3.3	5.2	3.9	4.6	5.2	10.5	7.8	5.9	8.5	11.1	7.8	8.5	6.5	5.9	19.3	8.6		
	18	0.0	3.9	3.9	5.2	5.2	6.5	6.5	7.8	10.5	4.6	5.2	13.1	4.6	10.5	4.6	7.8	19.1	8.5		
	19	0.0	3.3	6.5	7.2	5.2	8.5	2.0	5.9	8.5	9.2	5.9	7.8	7.2	7.2	9.8	5.9	19.0	8.5		
	20	0.0	3.3	5.9	9.2	5.3	7.9	6.6	5.3	4.6	7.9	7.2	7.9	8.6	6.6	5.9	7.9	18.7	8.4		
	21	0.0	4.0	7.3	5.3	8.6	4.0	3.3	6.0	6.6	7.9	4.6	13.9	8.6	5.3	5.3	9.3	19.2	8.6		
	22	0.0	2.7	5.3	10.0	8.0	4.7	2.0	6.0	3.3	5.3	9.3	12.0	11.3	5.3	5.3	9.3	19.5	8.7		
	23	0.0	5.3	8.6	7.9	4.0	6.6	4.0	6.0	4.6	6.6	3.3	12.6	9.9	5.3	7.3	7.9	19.1	8.5		
	24	0.0	3.9	9.9	7.9	3.9	5.3	5.3	7.2	5.9	5.3	4.6	9.2	8.6	7.9	7.9	7.2	19.0	8.5		
	ALL HOURS	0.0	4.2	4.9	6.3	4.9	5.0	4.4	5.7	5.8	5.8	5.7	11.7	9.9	8.6	7.4	9.8	20.8	9.3		

SOURCE: GEORESEARCH, INC.

**Table IV - 120**  
**Percentage Frequency Summary for Wind Speed**  
**PARK COUNTY - LIVINGSTON CANDIDATE WIND TURBINE SITE**  
**(SPRING)**

09/01/80 - 06/30/82

	CALM	WIND SPEED (MPH)																		AV (MPH)	AV (M/SEC)
		0.1- 2.0	2.1- 4.0	4.1- 6.0	6.1- 8.0	8.1- 10.0	10.1- 12.0	12.1- 14.0	14.1- 16.0	16.1- 18.0	18.1- 20.0	20.1- 25.0	25.1- 30.0	30.1- 35.0	35.1- 40.0	>40.0					
	CALM	WIND SPEED (METERS/SECOND)																			
1	0.0	2.9	19.4	15.5	16.5	2.9	4.9	2.9	7.8	7.8	4.9	9.7	1.9	1.9	1.0	0.0	0.0	10.7	4.8		
2	0.0	1.9	19.2	12.5	15.4	9.6	4.8	5.8	7.7	5.8	2.9	7.7	4.8	1.0	1.0	0.0	0.0	10.9	4.9		
3	0.0	3.9	19.4	12.6	8.7	7.8	5.8	7.8	6.8	6.8	4.9	6.8	4.9	2.9	1.0	0.0	0.0	11.4	5.1		
4	0.0	2.9	21.6	7.8	8.8	6.9	12.7	2.9	12.7	6.9	2.0	8.8	2.0	2.9	1.0	0.0	0.0	11.4	5.1		
5	0.0	4.9	14.6	8.7	10.7	12.6	6.8	2.9	9.7	8.7	7.8	6.8	1.0	4.9	0.0	0.0	0.0	11.7	5.2		
6	0.0	4.8	12.4	14.3	17.1	5.7	5.7	2.9	8.6	3.8	10.5	8.6	2.9	1.0	1.0	1.0	1.0	11.6	5.2		
7	0.0	5.8	12.5	17.3	5.8	11.5	5.8	4.8	3.8	8.7	6.7	8.7	5.8	1.9	1.0	0.0	0.0	11.7	5.2		
8	0.0	5.8	10.7	12.6	11.7	8.7	4.9	8.7	2.9	5.8	4.9	14.6	4.9	2.9	1.0	0.0	0.0	12.5	5.6		
H	9	0.0	1.0	9.9	11.9	12.9	10.9	3.0	7.9	4.0	5.9	4.0	16.8	6.9	4.0	1.0	0.0	13.8	6.2		
O	10	0.0	2.0	5.9	13.7	8.8	9.8	3.9	7.8	8.8	3.9	6.9	14.7	7.8	4.9	1.0	0.0	14.5	6.5		
O	11	0.0	1.0	6.1	13.1	12.1	6.1	5.1	5.1	6.1	5.1	6.1	19.2	11.1	3.0	0.0	1.0	15.1	6.7		
U	12	0.0	2.0	7.1	10.2	10.2	10.2	6.1	8.2	5.1	5.1	8.2	16.3	8.2	1.0	2.0	0.0	14.2	6.3		
U	13	0.0	1.0	4.1	11.2	11.2	9.2	2.0	8.2	13.3	5.1	6.1	15.3	11.2	1.0	1.0	0.0	14.7	6.6		
R	14	0.0	0.0	2.0	11.1	12.1	5.1	10.1	2.0	11.1	6.1	12.1	17.2	6.1	4.0	1.0	0.0	15.4	6.9		
R	15	0.0	1.0	2.9	7.8	8.8	9.8	8.8	4.9	5.9	10.8	12.7	17.6	4.9	2.9	1.0	0.0	15.3	6.8		
	16	0.0	0.0	1.0	6.8	9.7	12.6	10.7	9.7	6.8	7.8	9.7	17.5	1.9	4.9	1.0	0.0	15.1	6.8		
	17	0.0	1.0	3.8	7.7	7.7	6.7	6.7	11.5	11.5	9.6	12.5	13.5	3.8	1.9	1.0	1.0	15.0	6.7		
	18	0.0	0.0	3.9	10.7	10.7	8.7	10.7	8.7	11.7	7.8	4.9	13.6	4.9	1.9	1.0	1.0	14.3	6.4		
	19	0.0	0.0	4.9	10.7	13.6	8.7	13.6	10.7	5.8	7.8	5.8	11.7	4.9	0.0	1.0	1.0	13.3	6.0		
	20	0.0	0.0	3.9	13.7	17.6	9.8	11.8	8.8	5.9	10.8	2.0	9.8	2.9	1.0	1.0	1.0	12.6	5.6		
	21	0.0	1.9	12.5	14.4	14.4	7.7	10.6	6.7	6.7	7.7	4.8	7.7	2.9	0.0	1.0	1.0	11.4	5.1		
	22	0.0	1.9	8.7	19.4	13.6	9.7	9.7	6.8	8.7	1.0	5.8	10.7	1.9	1.0	1.0	0.0	11.1	5.0		
	23	0.0	1.9	19.4	15.5	12.6	9.7	7.8	1.0	6.8	5.8	3.9	12.6	1.9	1.0	0.0	0.0	10.5	4.7		
	24	0.0	3.8	21.2	15.4	13.5	7.7	3.8	5.8	1.9	6.7	4.8	9.6	3.8	1.0	1.0	0.0	10.5	4.7		
ALL HOURS		0.0	2.2	10.3	12.3	11.9	8.7	7.3	6.4	7.5	6.7	6.4	12.3	4.7	2.2	0.9	0.3	12.8	5.7		

SOURCE: GEORESEARCH, INC.

**Table IV - 121**  
**Percentage Frequency Summary for Wind Speed**  
**PARK COUNTY - LIVINGSTON CANDIDATE WIND TURBINE SITE**  
**(SUMMER)**

09/01/80 - 06/30/82

	CALM	WIND SPEED (MPH)															AV SPEED (MPH)	AV SPEED (M/SEC)	
		0.1- 2.0	2.1- 4.0	4.1- 6.0	6.1- 8.0	8.1- 10.0	10.1- 12.0	12.1- 14.0	14.1- 16.0	16.1- 18.0	18.1- 20.0	20.1- 25.0	25.1- 30.0	30.1- 35.0	35.1- 40.0	>40.0			
		0.1- 0.9	0.9- 1.8	1.8- 2.7	2.7- 3.6	3.6- 4.5	4.5- 5.4	5.4- 6.3	6.3- 7.2	7.2- 8.0	8.0- 8.9	8.9- 11.2	11.2- 13.4	13.4- 15.6	15.6- 17.9	>17.9			
1	0.0	0.0	15.5	20.4	15.5	10.7	7.8	10.7	3.9	5.8	7.8	1.0	0.0	1.0	0.0	0.0	9.4	4.2	
2	0.0	1.0	23.3	20.4	10.7	9.7	10.7	6.8	2.9	3.9	4.9	4.9	1.0	0.0	0.0	0.0	8.7	3.9	
3	0.0	1.0	21.4	28.2	12.6	5.8	7.8	3.9	7.8	3.9	3.9	1.9	1.9	0.0	0.0	0.0	8.4	3.8	
4	0.0	0.0	34.0	20.4	8.7	7.8	6.8	5.8	4.9	0.0	3.9	3.9	3.9	0.0	0.0	0.0	8.2	3.6	
5	0.0	2.9	28.2	24.3	4.9	11.7	4.9	4.9	1.9	3.9	5.8	4.9	1.9	0.0	0.0	0.0	8.3	3.7	
6	0.0	5.8	22.3	23.3	9.7	8.7	9.7	1.9	3.9	2.9	2.9	5.8	1.9	1.0	0.0	0.0	8.5	3.8	
7	0.0	2.9	27.2	22.3	9.7	4.9	7.8	3.9	4.9	5.8	1.9	6.8	0.0	1.0	1.0	0.0	8.7	3.9	
8	0.0	2.9	27.2	19.4	5.8	8.7	9.7	3.9	2.9	7.8	3.9	3.9	2.9	0.0	1.0	0.0	9.0	4.0	
H	9	0.0	0.0	22.3	13.6	14.6	6.8	4.9	5.8	7.8	9.7	4.9	5.8	2.9	1.0	0.0	10.3	4.6	
O	10	0.0	0.0	12.6	22.3	8.7	13.6	5.8	5.8	1.0	6.8	9.7	12.6	0.0	1.0	0.0	11.0	4.9	
U	11	0.0	0.0	7.8	18.4	15.5	10.7	4.9	7.8	7.8	6.8	8.7	8.7	1.0	0.0	1.9	0.0	11.5	5.2
R	12	0.0	0.0	4.0	20.0	14.0	14.0	8.0	4.0	5.0	7.0	12.0	9.0	1.0	1.0	1.0	0.0	12.0	5.4
	13	0.0	0.0	1.0	20.2	16.2	10.1	10.1	5.1	9.1	5.1	7.1	12.1	1.0	2.0	0.0	1.0	12.4	5.5
	14	0.0	0.0	2.0	11.9	7.9	11.9	11.9	8.9	9.9	9.9	5.0	15.8	3.0	0.0	2.0	0.0	14.0	6.3
	15	0.0	0.0	3.0	8.9	9.9	11.9	8.9	4.0	5.9	16.8	7.9	15.8	4.0	2.0	1.0	0.0	14.6	6.5
	16	0.0	0.0	0.0	4.0	14.9	13.9	10.9	5.9	6.9	10.9	10.9	11.9	7.9	1.0	1.0	0.0	14.7	6.6
	17	0.0	0.0	0.0	7.8	12.6	9.7	14.6	7.8	4.9	8.7	10.7	14.6	6.8	1.9	0.0	0.0	14.7	6.6
	18	0.0	0.0	1.0	7.7	9.6	16.3	8.7	11.5	3.8	13.5	9.6	10.6	5.8	1.9	0.0	0.0	14.2	6.4
	19	0.0	0.0	0.0	8.7	9.6	13.5	10.6	13.5	6.7	10.6	13.5	5.8	6.7	1.0	0.0	0.0	13.9	6.2
	20	0.0	0.0	2.9	10.6	7.7	12.5	15.4	14.4	5.8	12.5	6.7	8.7	2.9	0.0	0.0	0.0	12.9	5.8
	21	0.0	0.0	1.0	12.5	17.3	14.4	12.5	10.6	12.5	6.7	4.8	6.7	1.0	0.0	0.0	0.0	11.5	5.1
	22	0.0	0.0	5.7	13.3	19.0	15.2	9.5	9.5	6.7	5.7	7.6	5.7	1.9	0.0	0.0	0.0	10.9	4.9
	23	0.0	0.0	6.7	20.0	12.4	12.4	10.5	5.7	11.4	9.5	5.7	4.8	0.0	1.0	0.0	0.0	10.9	4.9
	24	0.0	0.0	9.6	27.9	14.4	9.6	7.7	4.8	7.7	6.7	9.6	1.9	0.0	0.0	0.0	0.0	9.6	4.3
	ALL HOURS	0.0	0.7	11.6	16.9	11.8	11.0	9.2	7.0	6.1	7.5	7.1	7.6	2.5	0.7	0.4	0.0	11.2	5.0

SOURCE: GEORESEARCH, INC.

**Table IV - 122**  
**Percentage Frequency Summary for Wind Speed**  
**PARK COUNTY - LIVINGSTON CANDIDATE WIND TURBINE SITE**  
**(AUTUMN)**

09/01/80 - 06/30/82

	CALM	WIND SPEED (MPH)															AV SPEED (MPH)	AV SPEED (M/SEC)	
		0.1-	2.1-	4.1-	6.1-	8.1-	10.1-	12.1-	14.1-	16.1-	18.1-	20.1-	25.1-	30.1-	35.1-	>40.0			
		2.0	4.0	6.0	8.0	10.0	12.0	14.0	16.0	18.0	20.0	25.0	30.0	35.0	40.0				
	CALM	0.1- 0.9	0.9- 1.8	1.8- 2.7	2.7- 3.6	3.6- 4.5	4.5- 5.4	5.4- 6.3	6.3- 7.2	7.2- 8.0	8.1- 8.9	9.0- 11.2	11.2- 13.4	13.5- 15.6	15.7- 17.9	>17.9			
1	0.0	0.6	12.2	11.0	11.0	8.1	10.5	6.4	5.2	5.8	5.2	10.5	6.4	1.7	4.1	1.2	13.9	6.2	
2	0.0	0.0	9.3	18.0	10.5	5.8	8.1	9.3	3.5	4.7	7.0	9.3	7.0	4.1	2.3	1.2	13.8	6.2	
3	0.0	1.2	13.5	12.3	8.2	6.4	7.0	7.6	6.4	7.0	3.5	13.5	5.3	4.7	2.9	0.6	14.1	6.3	
4	0.0	0.0	13.5	11.8	8.8	4.1	5.3	10.6	4.1	4.7	7.6	11.8	8.8	4.7	2.9	1.2	14.9	6.7	
5	0.0	0.0	17.5	9.4	10.5	1.8	7.0	5.3	8.2	5.8	5.8	12.9	8.2	2.3	4.1	1.2	14.6	6.5	
6	0.0	0.0	14.6	12.3	8.8	4.7	7.0	5.8	4.7	6.4	5.3	13.5	8.8	5.3	2.9	0.0	14.6	6.5	
7	0.0	0.6	12.8	12.2	11.0	4.7	2.9	6.4	6.4	5.2	5.8	14.5	9.9	2.9	4.1	0.6	14.9	6.7	
8	0.0	0.6	9.9	9.4	10.5	9.9	4.7	5.3	2.9	8.8	5.3	11.7	12.3	3.5	4.1	1.2	15.7	7.0	
H	9	0.0	0.6	9.9	9.3	8.7	5.2	7.0	5.8	5.8	6.4	4.7	16.3	8.7	5.8	2.9	2.9	16.5	7.4
O	10	0.0	0.0	9.3	5.8	5.8	4.1	8.7	10.5	2.3	7.0	6.4	15.7	12.2	6.4	2.9	2.9	17.7	7.9
U	11	0.0	0.6	5.9	8.2	6.5	4.7	4.1	8.2	7.6	3.5	6.5	18.8	12.4	5.9	4.1	2.9	18.2	8.1
R	12	0.0	0.0	5.9	8.8	6.5	4.7	4.7	2.9	7.6	7.1	10.6	15.9	12.9	7.1	4.1	1.2	18.2	8.1
	13	0.0	0.0	5.4	6.6	7.2	4.8	7.8	3.6	6.0	9.6	10.8	16.2	14.4	2.4	4.2	1.2	17.8	8.0
	14	0.0	0.0	4.8	4.8	6.1	7.3	9.1	6.7	10.3	5.5	9.1	17.6	12.7	1.2	3.0	1.8	17.3	7.7
	15	0.0	0.0	3.0	7.8	7.2	4.8	9.0	6.0	8.4	12.7	10.2	17.5	6.6	3.0	2.4	1.2	16.6	7.4
	16	0.0	0.0	2.4	6.5	8.2	6.5	5.3	10.6	13.5	8.2	11.2	12.9	7.6	3.5	1.8	1.8	16.8	7.5
	17	0.0	0.0	2.9	6.4	5.2	7.6	11.6	14.5	9.3	8.1	6.4	14.5	5.2	5.8	1.2	1.2	16.1	7.2
	18	0.0	0.0	2.9	8.7	5.2	9.2	13.9	13.3	6.9	11.0	8.1	8.7	5.8	3.5	0.0	2.9	15.3	6.9
	19	0.0	0.0	5.2	9.2	8.1	9.2	17.3	9.8	6.4	8.7	6.9	8.7	5.2	2.3	0.6	2.3	14.3	6.4
	20	0.0	0.0	5.2	12.7	7.5	11.0	11.0	11.0	9.8	5.2	5.8	9.8	6.9	1.7	0.6	1.7	14.0	6.3
	21	0.0	0.0	11.0	9.8	9.2	10.4	11.6	8.7	7.5	5.8	4.6	9.2	7.5	2.3	0.6	1.7	13.8	6.2
	22	0.0	0.0	10.9	16.1	9.2	6.9	8.0	9.8	9.2	3.4	5.7	9.2	4.6	5.2	0.0	1.7	13.4	6.0
	23	0.0	0.0	12.7	13.9	10.4	9.8	4.6	7.5	8.1	7.5	5.8	8.1	4.6	3.5	1.7	1.7	13.4	6.0
	24	0.0	0.6	12.7	15.6	7.5	4.6	12.1	6.9	5.8	5.2	5.8	9.8	5.8	4.6	1.7	1.2	13.6	6.1
ALL HOURS		0.0	0.2	8.9	10.3	8.3	6.5	8.3	8.0	6.9	6.8	6.8	12.7	8.3	3.9	2.5	1.6	15.4	6.9

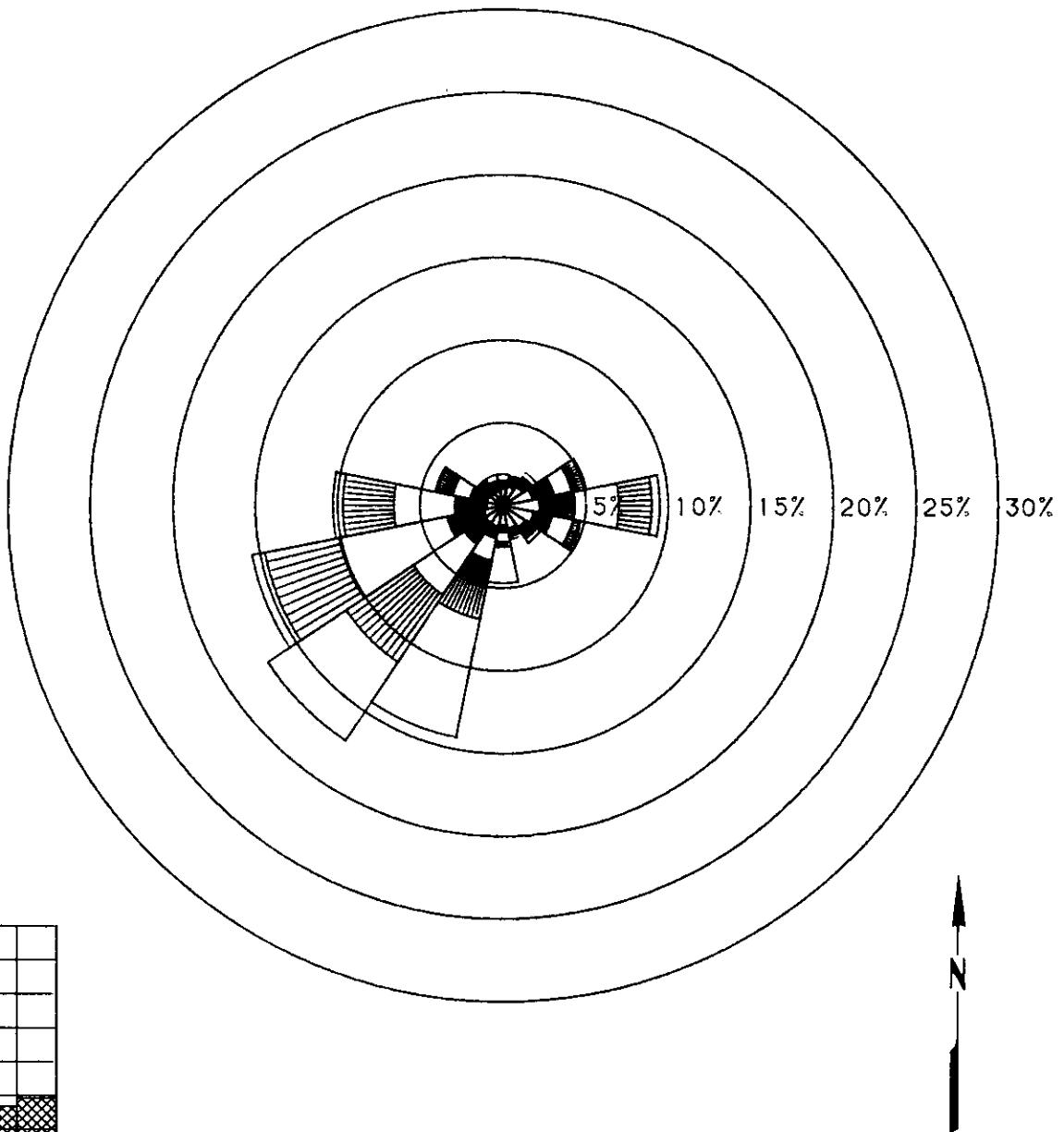
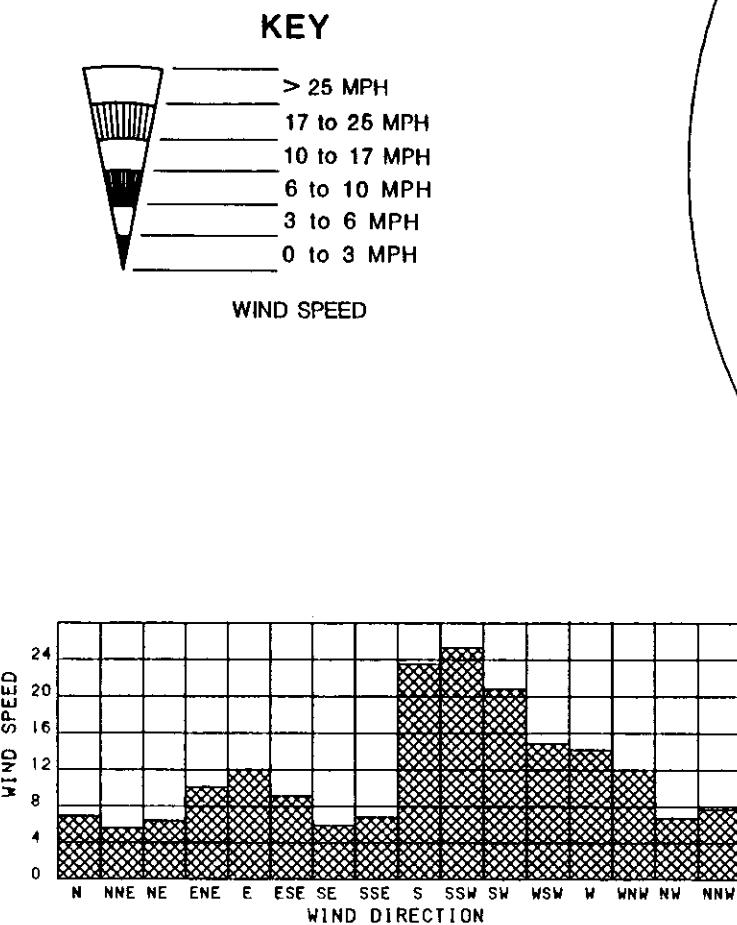
SOURCE: GEORESEARCH, INC.

**Table IV - 123**  
**Annual Wind Rose Distribution**  
**PARK COUNTY - LIVINGSTON CANDIDATE WIND TURBINE SITE**  
**09/01/80 - 06/30/82**

DIRECTION>	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL	<DIRECTION
SPEED (MPH)	SPEED (M/SEC)																	
0.1- 1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1- 0.4	
1.1- 2.0	0.1	0.0	0.1	0.2	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.1	0.1	0.1	0.1	1.8	0.5- 0.9	
2.1- 3.0	0.2	0.2	0.1	0.2	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	3.1	1.0- 1.3 S	
3.1- 4.0	0.2	0.3	0.4	0.3	0.6	0.7	0.5	0.4	0.4	0.3	0.3	0.2	0.2	0.2	0.2	5.5	1.4- 1.8 P	
4.1- 5.0	0.2	0.4	0.4	0.5	0.6	0.4	0.4	0.4	0.3	0.3	0.3	0.3	0.3	0.3	0.2	5.6	1.9- 2.2 E	
5.1- 6.0	0.3	0.3	0.4	0.6	0.6	0.4	0.3	0.2	0.2	0.3	0.3	0.3	0.3	0.2	0.3	5.2	2.3- 2.7 E	
6.1- 7.0	0.2	0.2	0.2	0.4	0.5	0.4	0.2	0.2	0.1	0.3	0.3	0.4	0.4	0.2	0.3	4.4	2.8- 3.1 D	
7.1- 8.0	0.1	0.2	0.1	0.4	0.6	0.3	0.2	0.2	0.1	0.2	0.4	0.5	0.5	0.3	0.3	4.3	3.2- 3.6	
D 8.1- 9.0	0.1	0.1	0.2	0.3	0.6	0.2	0.2	0.1	0.1	0.1	0.4	0.5	0.5	0.3	0.1	3.8	3.7- 4.0 M	
9.1-10.0	0.1	0.1	0.1	0.2	0.4	0.2	0.2	0.0	0.1	0.1	0.4	0.8	0.5	0.2	0.1	3.6	4.1- 4.5 E	
M 10.1-11.0	0.1	0.0	0.0	0.2	0.3	0.3	0.1	0.0	0.1	0.2	0.5	0.8	0.6	0.2	0.1	3.5	4.6- 4.9 T	
I 11.1-12.0	0.1	0.0	0.1	0.2	0.5	0.2	0.1	0.0	0.1	0.2	0.5	0.9	0.5	0.2	0.0	3.6	5.0- 5.4 E	
L 12.1-13.0	0.1	0.0	0.0	0.2	0.4	0.2	0.1	0.0	0.0	0.2	0.5	0.9	0.6	0.1	0.1	3.6	5.5- 5.8 R	
E 13.1-14.0	0.1	0.0	0.0	0.1	0.4	0.2	0.0	0.0	0.1	0.1	0.5	1.0	0.4	0.1	0.0	3.3	5.9- 6.3 S	
S 14.1-15.0	0.0	0.0	0.0	0.1	0.4	0.2	0.0	0.0	0.1	0.3	0.6	1.0	0.6	0.2	0.0	3.6	6.4- 6.7 /	
/ 15.1-16.0	0.0	0.0	0.0	0.1	0.3	0.1	0.0	0.0	0.1	0.2	0.6	1.0	0.4	0.1	0.0	3.0	6.8- 7.2 S	
H 16.1-17.0	0.0	0.0	0.0	0.2	0.4	0.1	0.0	0.0	0.1	0.2	0.5	1.1	0.6	0.2	0.0	3.5	7.3- 7.6 E	
O 17.1-18.0	0.0	0.0	0.0	0.2	0.4	0.0	0.0	0.0	0.0	0.3	0.5	0.9	0.7	0.2	0.0	3.2	7.7- 8.0 C	
U 18.1-19.0	0.0	0.0	0.0	0.1	0.3	0.1	0.0	0.0	0.0	0.4	0.6	0.8	0.6	0.1	0.0	3.2	8.1- 8.5 O	
R 19.1-20.0	0.0	0.0	0.0	0.1	0.4	0.1	0.0	0.0	0.1	0.5	0.6	0.6	0.5	0.2	0.0	3.2	8.6- 8.9 N	
20.1-25.0	0.0	0.0	0.0	0.4	0.9	0.2	0.0	0.0	0.2	2.4	3.2	2.3	1.3	0.5	0.0	11.4	9.0-11.2 D	
25.1-30.0	0.0	0.0	0.0	0.1	0.4	0.1	0.0	0.0	0.2	2.5	2.4	0.7	0.4	0.1	0.0	6.9	11.3-13.4	
30.1-35.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	1.9	1.6	0.1	0.1	0.0	0.0	4.3	13.5-15.6	
35.1-40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	1.5	1.0	0.0	0.0	0.0	0.0	3.1	15.7-17.9	
>40.0	0.0	0.1	0.3	0.0	0.1	0.0	0.0	0.2	0.9	1.4	0.7	0.0	0.1	0.0	0.0	3.6	>17.9	
CALM															0.0	CALM		
TOTAL AV SPEED (MPH)	1.9	1.9	2.4	5.1	9.5	4.8	2.5	2.1	4.7	14.3	17.1	15.5	10.3	4.1	1.9	1.9	0.0	TOTAL AV SPEED (MPH)
AV SPEED (M/SEC)	6.9	5.6	6.4	10.1	12.0	9.1	5.9	6.8	23.5	25.3	20.8	14.9	14.2	12.0	6.7	7.7	15.6	AV SPEED (M/SEC)

SOURCE: GEORESEARCH, INC.

**LIVINGSTON CANDIDATE WIND TURBINE SITE — PARK COUNTY**  
**(1980 - 1982)**



**Table IV - 124**  
**Coefficients of Weibull Distribution**  
**PARK COUNTY - LIVINGSTON CANDIDATE WIND TURBINE SITE**  
**09/01/80 - 06/30/82**

MONTH	SCALE FACTOR (C) (M/SEC)	SHAPE FACTOR (K)
JANUARY	8.7041	1.4656
FEBRUARY	13.0890	1.0187
MARCH	6.2942	1.4434
APRIL	7.7433	1.4614
MAY	5.1236	1.7195
JUNE	5.6831	1.7094
JULY	5.8437	1.6060
AUGUST	4.3808	1.6394
SEPTEMBER	5.3428	1.6717
OCTOBER	7.5914	1.5903
NOVEMBER	10.3296	1.7203
DECEMBER	12.2643	1.5990
YEAR	7.5403	1.4615

SOURCE: GEORESEARCH, INC.

# LIVINGSTON FAA AIRPORT

## PARK COUNTY

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The old Livingston airport, now abandoned, was located approximately 1 mile east of Livingston at 45° 40' 12" N and 110° 31' 48" W (Site No. 96 on Map II-1). The airport sat in the Yellowstone River Valley at an elevation of 4,590 feet, just north of the Absaroka Mountains, which rise to more than 11,000 feet. To the southwest is the Gallatin Range, and to the northwest is the Bridger Range. Both ranges have summits over 9,000 feet. Northeast of the area are the Crazy Mountains, which rise to over 11,000 feet. Two major river valleys intersect in this area: the Paradise Valley to the southwest, through which the upper Yellowstone River flows, and the Shields River Valley to the north.

Most of the land in the valley is privately owned, although there are a few scattered sections of publicly owned land. Land in the mountains is controlled predominantly by the U.S. Forest Service. Much of the privately owned land has been leased for wind energy use.

Electrical service in the area is provided by the Montana Power Company and the Park Electric Cooperative. A number of transmission lines run through the valley.

Meteorological data had been collected at this site for several years by the Federal Aviation Administration. These data, collected primarily for aviation and weather forecasting uses, consist of short-term (5 minutes or less) averages of wind speed and wind direction, as well as other meteorological parameters. Data were gathered once per hour. The data have been analyzed by Battelle Pacific Northwest Laboratories.

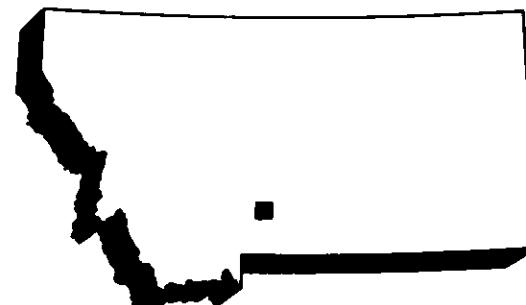
The Battelle data set for Livingston consists of summaries, for two time periods, of data gathered at different anemometer heights: January 1, 1948, through July 4, 1953; and July 5, 1953, through December 31, 1954. Only hourly data from the earlier period were selected for inclusion in this *Atlas*. These data were gathered by an anemometer mounted on a beacon tower at a height of 17.4 meters. Because of complex terrain in the area, the site is representative only of a limited area of the upper Yellowstone River Valley near Livingston.

Average annual wind speed at the site was 15.7 miles per hour. Average monthly wind speeds varied from 10.7 miles per hour in July to 21.9 miles per hour in January.

Average annual wind power was 510.0 watts/m<sup>2</sup>. Average monthly wind power ranged from 137.0 watts/m<sup>2</sup> in July to 1,175.0 watts/m<sup>2</sup> in January.

Average seasonal wind speeds were 11.4 miles per hour in summer, 14.5 miles per hour in spring, 15.4 miles per hour in autumn, and 21.1 miles per hour in winter. The highest average wind speeds occurred around noon in winter, early to mid-afternoon in spring and autumn, and late afternoon in summer. The lowest average wind speeds occurred shortly after midnight in autumn, in the early morning in spring and summer, and in early evening in winter. The diurnal range of average wind speeds was greatest in summer and least in winter.

The most common wind directions were south-southwest through west-southwest. Winds from the southeast and west-northwest were least common. By direction, average wind speeds ranged from 6.0 miles per hour for southeast winds to 24.6 miles per hour for winds from the south-southwest. The strongest winds were from the prevailing wind directions.



**Table IV - 125**  
**Monthly Wind Speed Distribution**  
**PARK COUNTY - LIVINGSTON FAA AIRPORT**

01/01/48 - 07/04/53

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR	
CALM (<1.1)	1.3	1.1	2.2	1.5	1.2	1.4	2.0	2.0	1.9	2.8	1.6	1.9	1.7	CALM (<0.5)
1.1- 3.1	1.8	1.1	2.3	1.5	2.3	1.6	4.2	3.1	2.5	2.5	0.7	1.0	2.0	0.5- 1.4
3.4- 5.4	7.2	7.2	11.1	11.8	14.7	14.8	19.8	17.7	17.6	14.8	6.5	7.4	12.5	1.5- 2.4 S
S 5.6- 7.6	4.4	4.6	6.0	7.2	7.8	9.4	11.6	11.9	9.3	7.6	4.2	4.2	7.3	2.5- 3.4 P
P 7.8- 9.8	4.6	5.7	6.5	9.4	10.3	12.4	12.5	11.6	10.8	7.2	5.0	4.9	8.4	3.5- 4.4 E
E 10.1-12.1	8.8	10.2	13.2	15.9	16.1	19.4	16.7	17.4	18.1	13.9	11.9	9.0	14.2	4.5- 5.4 E
E 12.3-14.3	5.3	4.8	5.9	7.2	6.8	6.8	7.3	7.0	7.1	6.6	6.5	5.4	6.4	5.5- 6.4 D
D 14.5-16.6	6.4	6.1	7.3	8.4	7.9	7.5	5.3	7.1	7.4	6.0	8.0	7.0	7.1	6.5- 7.4
16.8-18.8	9.7	11.5	12.8	13.0	10.9	10.2	8.4	8.2	9.7	10.1	13.0	11.5	10.8	7.5- 8.4 M
M 19.0-21.0	7.1	8.6	8.2	8.1	8.1	6.9	5.3	5.2	5.8	7.0	9.1	8.4	7.4	8.5- 9.4 E
I 21.3-23.3	4.1	5.2	4.6	4.1	3.6	3.0	2.0	3.0	2.2	2.8	4.7	4.6	3.7	9.5-10.4 T
L 23.5-25.5	5.4	5.2	4.5	3.8	3.5	2.4	2.3	2.0	2.7	2.9	5.3	4.8	3.8	10.5-11.4 E
E 25.7-27.7	5.4	5.4	4.4	3.3	3.1	1.6	0.9	1.7	2.2	4.1	5.5	5.1	3.6	11.5-12.4 R
S 28.0-30.0	4.1	3.4	2.6	1.4	1.6	0.9	0.7	0.7	1.1	2.5	3.2	3.5	2.2	12.5-13.4 S
/ 30.2-32.2	2.8	2.4	1.7	1.0	0.7	0.5	0.3	0.5	0.4	1.7	1.9	2.8	1.4	13.5-14.4 /
H 32.4-34.4	4.1	3.1	2.0	0.6	0.8	0.2	0.5	0.4	0.5	1.8	2.7	4.7	1.8	14.5-15.4 S
O 34.7-36.7	1.7	1.1	0.6	0.3	0.3	0.3	0.2	0.1	0.2	0.9	1.2	2.2	0.8	15.5-16.4 E
U 36.9-38.9	2.3	1.8	0.7	0.4	0.0	0.2	0.0	0.1	0.1	0.9	1.2	2.1	0.8	16.5-17.4 C
R 39.1-41.2	2.8	2.2	0.8	0.4	0.1	0.2	0.1	0.1	0.2	1.0	1.8	2.8	1.0	17.5-18.4 O
41.4-43.4	2.4	1.7	0.7	0.3	0.1	0.2	0.0	0.1	0.0	0.7	1.7	1.5	0.8	18.5-19.4 N
43.6-45.6	2.3	1.7	0.4	0.2	0.1	0.0	0.0	0.0	0.0	0.9	1.5	1.6	0.7	19.5-20.4 D
45.9-56.8	5.2	5.0	0.9	0.1	0.0	0.1	0.0	0.1	0.0	1.1	2.6	2.9	1.5	20.5-25.4
57.0-68.0	0.7	1.0	0.4	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.5	0.2	25.5-30.4
68.2-79.2	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	30.5-35.4
79.4-90.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	35.5-40.4
>90.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	>40.4
AVERAGE SPEED (MPH)	21.9	20.8	16.1	14.1	13.2	12.3	10.7	11.2	11.9	15.0	19.2	20.6	15.7	
AVERAGE SPEED (M/SEC)	9.8	9.3	7.2	6.3	5.9	5.5	4.8	5.0	5.3	6.7	8.6	9.2	7.0	
AVERAGE WIND POWER (WATTS/M**2)	1175.0	1055.0	513.0	293.0	230.0	191.0	137.0	153.0	178.0	446.0	769.0	949.0	510.0	

ANEMOMETER HEIGHT = 57.0 FEET = 17.4 METERS

SOURCE: BATTELLE PACIFIC NORTHWEST LABORATORIES

Table IV - 126

## Percentage Frequency Summary for Wind Speed

## PARK COUNTY - LIVINGSTON FAA AIRPORT (WINTER)

01/01/48 - 07/04/53

	WIND SPEED (MPH)															AV	AV	
	0.5-	1.5-	2.5-	3.5-	4.5-	5.5-	6.5-	7.5-	8.5-	9.5-	10.5-	11.5-	12.5-	13.5-	>14.4	SPEED	SPEED	
	1.4	2.4	3.4	4.4	5.4	6.4	7.4	8.4	9.4	10.4	11.4	12.4	13.4	14.4		(MPH)	(M/SEC)	
	WIND SPEED (M/SEC)																	
	<1.1	1.1-	3.4-	5.6-	7.8-	10.1-	12.3-	14.5-	16.8-	19.0-	21.3-	23.5-	25.7-	28.0-	30.2-			
	3.1	5.4	7.6	9.8	12.1	14.3	16.6	18.8	21.0	23.3	25.5	27.7	30.0	32.2	>32.2			
1	2.4	0.9	9.2	3.7	5.5	8.7	5.0	4.6	11.7	7.2	4.1	5.5	4.1	5.1	2.7	19.7	21.0	9.4
2	1.4	1.5	9.2	4.7	5.3	8.1	4.5	6.1	11.1	7.3	4.2	4.8	7.3	3.3	3.2	18.0	20.6	9.2
3	1.2	1.9	9.1	2.9	4.6	10.7	5.1	5.7	13.2	7.1	2.8	6.8	6.3	4.9	2.1	15.7	20.3	9.1
4	2.8	1.6	9.1	4.1	3.8	9.4	5.2	4.9	11.5	9.5	4.8	5.4	5.6	1.9	3.7	16.7	20.5	9.2
5	1.6	2.2	7.3	5.8	4.1	8.6	5.3	8.0	11.6	8.1	5.6	4.0	5.1	3.2	2.2	17.3	20.4	9.1
6	2.2	2.4	7.7	3.1	5.0	9.2	4.8	6.7	12.0	8.6	4.4	3.6	5.1	3.2	4.0	18.0	20.7	9.3
7	2.6	1.0	7.0	5.0	4.7	8.6	6.6	6.5	10.2	7.9	4.8	3.9	6.5	3.3	3.8	17.6	20.7	9.2
8	1.8	0.8	8.3	4.5	5.6	7.9	5.7	6.3	10.2	7.3	5.7	4.5	5.5	4.1	2.0	19.6	20.8	9.3
H	1.8	0.8	6.1	4.9	5.2	11.1	3.8	5.2	11.2	10.7	3.7	6.5	4.7	3.8	1.7	18.9	21.2	9.5
9	1.4	1.6	5.6	3.6	4.6	10.2	4.6	7.2	8.2	9.8	5.9	4.9	5.4	3.0	2.3	21.6	22.0	9.8
O	1.4	0.7	5.6	4.0	4.9	9.2	2.5	7.9	9.4	9.8	5.1	5.3	6.1	4.0	3.0	21.2	22.4	10.0
U	1.0	1.3	4.7	4.0	5.0	6.7	4.7	5.6	9.0	10.2	5.6	5.2	6.1	5.5	2.5	23.0	23.3	10.4
U	0.8	1.1	4.7	3.6	4.3	6.9	4.7	6.4	11.8	9.3	4.4	6.3	6.6	4.5	2.8	21.8	22.8	10.2
R	0.4	0.8	5.0	4.5	3.1	9.2	4.7	7.4	11.1	9.5	4.7	6.0	4.6	4.5	3.9	20.5	22.6	10.1
15	0.8	1.1	4.7	2.3	5.3	9.7	3.5	8.4	13.2	9.4	4.6	5.8	4.8	4.1	2.0	20.2	21.9	9.8
16	0.2	0.4	4.8	6.5	3.5	9.5	6.9	8.0	10.7	8.7	5.3	5.2	6.7	3.3	2.8	17.7	21.3	9.5
17	1.3	0.8	8.0	4.0	4.5	9.1	6.0	7.2	14.5	6.4	4.1	5.8	4.0	3.5	1.9	19.1	20.8	9.3
18	1.1	1.7	7.0	3.8	5.4	10.1	6.5	7.0	13.5	8.5	3.7	5.8	4.7	2.0	2.1	17.2	20.2	9.0
19	1.4	1.4	7.7	4.5	6.6	10.4	6.1	6.8	9.7	7.2	4.1	4.2	5.6	3.1	2.3	19.0	20.4	9.1
20	1.5	0.9	7.1	5.7	6.2	11.5	6.1	6.8	10.0	3.9	5.1	4.8	4.6	4.5	2.2	19.0	20.6	9.2
21	1.0	1.8	8.1	6.5	7.4	7.6	5.1	7.1	10.2	5.4	4.3	6.1	3.8	4.0	1.8	19.8	20.5	9.1
22	1.2	1.4	10.8	4.3	6.4	9.1	6.1	5.5	8.8	5.0	5.0	5.0	5.5	2.8	3.4	19.6	20.7	9.2
23	1.2	1.9	7.7	4.1	5.9	12.6	5.6	6.0	9.4	6.7	4.0	4.0	4.3	2.6	2.8	21.3	20.7	9.2
24	2.0	2.1	9.6	5.2	4.0	9.4	4.9	4.9	8.4	8.9	4.6	4.0	4.0	4.5	2.5	21.1	20.8	9.3
ALL HOURS	1.4	1.3	7.3	4.4	5.0	9.3	5.2	6.5	10.9	8.0	4.6	5.1	5.3	3.7	2.7	19.3	21.1	9.4

SOURCE: BATTELLE PACIFIC NORTHWEST LABORATORIES

**Table IV - 127**  
**Percentage Frequency Summary for Wind Speed**  
**PARK COUNTY - LIVINGSTON FAA AIRPORT (SPRING)**  
**01/01/48 - 07/04/53**

	<0.5	WIND SPEED (MPH)														AV SPEED (MPH)	AV SPEED (M/SEC)		
		0.5-	1.5-	2.5-	3.5-	4.5-	5.5-	6.5-	7.5-	8.5-	9.5-	10.5-	11.5-	12.5-	13.5-				
	<1.1	1.1-	3.4-	5.6-	7.8-	10.1-	12.3-	14.5-	16.8-	19.0-	21.3-	23.5-	25.7-	28.0-	30.2-	>32.2			
		1.1-	3.4-	5.6-	7.8-	10.1-	12.3-	14.5-	16.8-	19.0-	21.3-	23.5-	25.7-	28.0-	30.2-	>32.2			
1	2.4	1.8	14.9	7.8	11.1	17.9	5.1	5.8	10.3	7.6	4.2	3.4	2.7	1.1	0.7	3.3	13.3	5.9	
2	2.7	2.9	17.4	7.1	12.5	13.1	6.2	6.0	8.9	8.2	4.0	2.7	2.5	2.5	0.5	2.9	13.0	5.8	
3	2.2	2.0	16.5	10.1	11.1	15.4	5.2	6.3	10.9	5.4	3.6	2.5	3.8	1.7	0.9	2.4	12.9	5.8	
4	3.7	4.0	16.7	6.7	9.2	14.8	4.7	7.8	11.8	5.8	3.8	3.3	3.1	1.5	0.2	3.1	12.9	5.8	
5	2.2	3.8	17.8	8.5	7.8	13.0	7.6	7.5	9.5	7.1	5.1	2.7	3.8	0.7	0.7	2.3	13.0	5.8	
6	2.5	3.1	18.1	10.3	6.6	12.7	6.5	5.3	11.2	8.0	3.8	4.7	3.1	1.3	0.7	2.2	13.0	5.8	
7	2.7	3.6	15.9	5.8	11.6	12.3	6.3	7.8	10.3	7.4	2.5	5.2	4.6	0.9	0.7	2.2	13.2	5.9	
8	2.2	3.1	12.3	7.1	4.7	16.6	8.0	8.3	12.0	9.2	3.3	2.6	4.0	1.6	1.8	3.3	14.4	6.4	
H	9	1.6	2.7	12.5	5.1	5.8	12.3	8.3	7.5	14.0	9.8	3.6	4.0	4.1	2.2	1.1	5.5	15.4	6.9
O	10	2.2	2.4	10.9	4.9	6.7	12.5	6.2	9.1	11.8	9.8	5.3	5.8	4.2	2.9	1.5	4.2	15.7	7.0
O	11	0.7	2.0	9.1	6.7	7.6	12.5	6.7	9.1	13.6	9.8	5.5	4.2	4.4	2.0	1.6	4.7	15.8	7.1
U	12	1.1	2.2	8.9	3.4	6.9	12.5	6.5	10.3	15.6	11.4	4.0	5.3	4.3	2.8	0.6	4.3	16.1	7.2
U	13	0.6	0.9	6.0	5.4	9.4	13.6	8.1	9.8	15.4	8.0	6.2	4.7	3.8	1.6	1.8	4.7	16.3	7.3
R	14	0.3	1.6	6.9	5.3	7.2	13.0	8.7	8.0	13.2	12.7	4.0	4.9	5.8	2.9	1.1	4.4	16.6	7.4
R	15	0.2	0.7	6.9	5.6	8.7	13.8	6.2	11.4	12.1	9.8	5.8	5.6	4.0	2.9	1.6	4.8	16.7	7.5
	16	0.7	0.5	6.6	6.2	6.2	15.4	7.6	9.4	15.8	10.3	4.3	4.3	4.0	2.0	2.0	4.7	16.6	7.4
	17	0.2	0.2	9.1	5.6	7.3	15.2	7.6	8.5	16.9	8.7	5.6	4.2	3.6	2.2	1.3	4.0	16.1	7.2
	18	0.7	1.6	8.9	5.3	9.4	15.9	6.0	9.6	17.2	6.7	5.1	3.6	3.3	1.3	1.4	3.9	15.4	6.9
	19	1.4	0.9	10.0	6.3	8.0	20.5	8.9	8.3	12.2	7.4	3.7	4.2	2.2	1.8	1.8	2.4	14.4	6.4
	20	1.5	1.3	14.5	7.0	11.4	19.4	6.0	7.3	11.6	6.0	2.5	2.4	3.6	1.8	1.5	2.3	13.4	6.0
	21	2.0	1.3	14.7	10.1	10.3	18.1	4.9	7.4	10.7	5.4	2.6	3.6	3.1	1.1	2.0	2.8	13.3	5.9
	22	2.3	3.1	15.1	8.3	10.9	15.8	6.0	5.4	8.2	8.2	3.6	4.2	2.5	2.7	0.9	2.9	13.4	6.0
	23	1.8	1.4	13.9	10.1	12.0	16.9	4.9	6.9	9.1	7.3	3.8	3.1	2.9	1.6	0.7	3.6	13.3	6.0
	24	1.6	1.6	17.6	8.9	8.0	18.3	6.9	6.2	11.2	5.8	2.0	3.2	2.9	1.7	0.9	3.2	13.1	5.9
	ALL HOURS	1.6	2.0	12.5	7.0	8.7	15.1	6.6	7.9	12.2	8.1	4.1	3.9	3.6	1.9	1.1	3.5	14.5	6.5

SOURCE: BATTELLE PACIFIC NORTHWEST LABORATORIES

Table IV - 128

## Percentage Frequency Summary for Wind Speed

## PARK COUNTY - LIVINGSTON FAA AIRPORT (SUMMER)

01/01/48 - 07/04/53

	WIND SPEED (MPH)															AV	AV		
	<0.5	0.5-	1.5-	2.5-	3.5-	4.5-	5.5-	6.5-	7.5-	8.5-	9.5-	10.5-	11.5-	12.5-	13.5-	>14.4	SPEED	SPEED	
	<1.1	1.1-	3.4-	5.6-	7.8-	10.1-	12.3-	14.5-	16.8-	19.0-	21.3-	23.5-	25.7-	28.0-	30.2-	>32.2	(MPH)	(M/SEC)	
1	1.2	4.5	22.8	11.0	17.2	17.6	6.9	6.0	6.3	2.2	1.6	1.9	0.4	0.2	0.0	0.2	9.5	4.3	
2	2.6	2.5	27.7	12.9	12.2	15.9	5.2	5.2	8.1	3.5	1.2	1.1	0.8	0.2	0.0	0.8	9.5	4.2	
3	3.1	7.3	25.5	13.3	12.3	18.1	2.3	3.8	7.5	3.0	1.4	1.0	0.6	0.2	0.2	0.2	8.9	4.0	
4	4.1	5.5	30.1	11.8	12.6	13.7	5.0	4.7	5.8	3.3	1.1	1.0	0.4	0.2	0.0	0.6	8.6	3.8	
5	5.6	8.1	26.3	11.7	11.7	15.0	3.8	4.1	5.3	5.6	1.0	0.2	0.2	0.2	0.8	0.6	8.6	3.8	
6	4.3	6.9	29.9	9.0	13.6	14.0	5.3	3.8	6.2	3.0	1.4	1.4	0.2	0.6	0.4	0.2	8.6	3.9	
7	6.4	6.9	21.2	12.0	13.9	13.2	4.5	4.0	7.7	5.0	2.4	0.9	0.6	0.2	0.4	0.6	9.3	4.2	
8	2.8	5.5	24.2	10.5	8.3	15.3	5.5	6.7	9.5	4.5	2.1	2.4	0.4	1.2	0.6	0.4	10.3	4.6	
H	9	1.6	2.5	16.4	12.3	10.5	22.0	6.9	4.9	10.0	6.1	2.6	1.6	1.4	0.6	0.4	0.2	11.2	5.0
O	10	1.7	1.8	15.6	12.5	11.7	19.0	8.4	8.0	7.9	4.9	3.9	2.0	1.8	0.4	0.0	0.4	11.3	5.1
U	11	0.6	2.4	17.5	11.7	10.1	17.8	6.6	8.1	9.1	7.4	2.8	2.4	1.0	1.4	0.4	0.8	11.8	5.3
R	12	0.6	1.7	16.2	10.8	10.6	17.6	8.6	7.0	8.7	7.9	3.3	2.4	1.8	1.6	0.2	1.0	12.2	5.5
	13	0.4	1.3	12.0	7.8	11.0	18.7	7.9	8.9	10.1	9.1	3.4	3.6	1.8	1.6	0.6	1.8	13.4	6.0
	14	0.8	1.2	8.4	10.5	10.5	17.2	6.9	8.8	10.7	10.8	5.0	3.6	2.0	1.2	0.6	1.8	13.9	6.2
	15	1.0	0.8	6.7	9.8	10.3	16.7	8.5	9.0	10.6	9.2	4.5	5.4	2.4	1.6	0.6	2.8	14.7	6.6
	16	0.0	0.4	8.5	7.9	8.5	15.4	11.7	9.8	10.0	11.3	5.4	2.8	4.0	1.7	0.4	2.2	14.8	6.6
	17	0.2	0.4	6.6	7.0	11.7	19.5	9.6	7.1	15.4	8.6	3.8	4.4	2.0	0.9	1.4	1.4	14.4	6.4
	18	0.4	0.4	9.1	6.9	10.2	18.9	8.7	8.4	15.2	9.1	2.4	3.0	2.7	1.8	1.3	1.6	14.2	6.4
	19	0.8	0.4	11.2	9.1	11.7	20.0	7.5	9.3	11.8	6.7	3.9	2.8	1.8	1.2	0.6	1.0	13.1	5.9
	20	0.4	1.6	13.3	10.2	13.5	20.3	8.1	8.2	9.0	5.8	3.2	2.8	1.8	0.4	0.2	1.0	12.1	5.4
	21	0.8	1.7	15.3	9.5	17.1	21.0	8.7	6.8	9.1	3.2	2.6	1.8	0.8	0.4	0.8	0.4	11.3	5.1
	22	1.5	1.7	15.3	12.3	16.0	25.6	7.6	4.6	7.2	2.7	1.4	1.6	1.4	0.0	0.0	1.0	10.7	4.8
	23	1.0	1.5	18.8	15.6	16.4	16.9	8.3	6.9	6.5	3.3	1.8	0.8	1.4	0.4	0.4	0.2	10.3	4.6
	24	1.4	4.3	21.1	17.4	10.8	18.5	6.1	5.1	6.3	3.0	1.9	2.1	1.3	0.2	0.2	0.4	9.8	4.4
ALL HOURS	1.8	3.0	17.5	11.0	12.2	17.8	7.0	6.6	8.9	5.8	2.7	2.2	1.4	0.8	0.4	1.0	11.4	5.1	

SOURCE: BATTELLE PACIFIC NORTHWEST LABORATORIES

Table IV - 129

## Percentage Frequency Summary for Wind Speed

## PARK COUNTY - LIVINGSTON FAA AIRPORT (AUTUMN)

01/01/48 - 07/04/53

	WIND SPEED (MPH)															AV	AV		
	0.5-	1.5-	2.5-	3.5-	4.5-	5.5-	6.5-	7.5-	8.5-	9.5-	10.5-	11.5-	12.5-	13.5-	>14.4	SPEED	SPEED		
	1.4	2.4	3.4	4.4	5.4	6.4	7.4	8.4	9.4	10.4	11.4	12.4	13.4	14.4		(MPH)	(M/SEC)		
	1.1-	3.4-	5.6-	7.8-	10.1-	12.3-	14.5-	16.8-	19.0-	21.3-	23.5-	25.7-	28.0-	30.2-					
	3.1	5.4	7.6	9.8	12.1	14.3	16.6	18.8	21.0	23.3	25.5	27.7	30.0	32.2	>32.2				
1	2.8	2.9	21.3	7.7	9.7	12.5	5.7	3.1	10.1	7.0	2.6	4.0	3.1	1.3	0.7	5.4	13.3	5.9	
2	4.6	3.7	18.7	6.4	8.6	12.3	4.9	7.9	8.1	6.8	2.4	3.5	3.8	2.2	1.8	4.4	13.4	6.0	
3	4.0	4.6	14.9	8.3	9.0	11.0	5.5	5.5	12.3	5.3	2.4	3.7	5.1	2.0	1.1	5.3	13.9	6.2	
4	3.3	3.1	18.7	5.7	7.5	10.1	6.4	5.7	12.3	6.2	4.2	3.7	3.5	2.6	1.6	5.5	14.5	6.5	
5	4.4	3.9	13.4	6.0	8.6	14.3	6.8	6.6	9.4	5.5	3.7	3.3	3.5	3.1	1.8	5.8	14.5	6.5	
6	4.2	2.0	15.4	6.2	7.7	14.0	6.4	6.4	12.3	5.7	2.8	4.2	3.5	1.1	1.5	6.6	14.5	6.5	
7	3.6	3.8	15.4	7.9	5.3	15.4	5.7	6.6	9.2	6.4	3.9	4.0	3.1	2.0	1.3	6.6	14.5	6.5	
8	4.4	2.2	14.7	5.5	7.0	14.1	3.3	8.1	10.1	7.7	3.7	3.9	2.2	1.5	7.7	15.2	6.8		
H	9	1.3	2.2	10.8	5.9	7.0	14.1	7.5	7.5	9.0	11.0	4.4	4.2	2.4	0.9	7.7	16.3	7.3	
O	10	1.5	1.3	8.8	5.5	5.9	16.0	8.8	6.6	12.5	7.0	4.2	5.1	2.4	0.7	8.2	16.9	7.6	
U	11	0.4	1.3	10.3	5.3	5.7	14.0	5.9	7.2	13.9	8.6	2.8	4.0	4.4	4.6	2.0	9.4	17.7	7.9
U	12	1.1	0.9	7.9	6.0	5.3	16.5	8.3	7.0	9.9	9.2	3.8	4.6	5.3	2.6	1.3	10.4	17.6	7.9
R	13	0.2	0.6	8.1	5.9	6.4	16.1	6.6	8.1	11.2	9.2	5.3	5.5	3.5	3.7	0.7	8.8	17.5	7.8
R	14	0.4	0.9	7.7	5.5	4.4	14.3	7.9	7.5	11.7	12.8	4.9	3.5	5.5	2.6	2.4	8.1	17.8	8.0
R	15	0.2	0.4	5.5	5.5	5.5	14.7	8.6	9.9	14.1	11.4	3.9	3.3	5.0	1.5	1.7	8.6	17.7	7.9
R	16	0.4	0.4	7.3	4.4	7.7	12.8	8.1	11.0	14.3	10.1	4.2	3.9	3.7	3.1	0.6	7.9	17.2	7.7
R	17	0.2	0.9	9.0	3.5	7.7	16.2	10.8	9.9	14.7	7.2	2.8	5.3	2.4	1.5	0.7	7.0	16.2	7.2
R	18	0.2	0.4	10.3	7.0	10.3	21.8	7.2	7.3	11.2	5.9	1.8	2.4	4.2	1.3	1.3	7.2	15.2	6.8
R	19	0.5	1.3	12.3	9.2	9.6	20.0	7.7	6.3	10.1	5.3	2.0	3.3	2.0	1.5	1.5	7.3	14.7	6.6
R	20	0.6	1.1	11.9	11.0	13.4	15.2	6.6	7.5	8.6	5.9	3.1	1.7	3.3	1.8	2.0	6.3	14.4	6.4
R	21	2.4	1.3	14.3	10.6	9.9	15.0	4.8	6.6	10.1	4.4	2.6	3.5	4.6	1.8	1.5	6.6	14.5	6.5
R	22	2.0	1.3	17.8	11.9	7.7	12.7	5.5	6.4	10.6	5.5	1.3	3.1	3.3	2.6	0.7	7.7	14.2	6.4
R	23	2.9	1.3	20.4	11.0	5.9	13.6	5.5	6.0	7.2	5.7	2.9	2.4	4.6	2.4	1.5	6.5	13.9	6.2
R	24	4.2	4.2	17.1	7.0	8.4	14.3	6.2	6.4	9.2	5.9	2.2	1.8	3.9	1.8	1.5	5.9	13.6	6.1
ALL HOURS	2.1	1.9	13.0	7.0	7.7	14.6	6.7	7.1	10.9	7.3	3.2	3.6	3.9	2.3	1.3	7.1	15.4	6.9	

SOURCE: BATTELLE PACIFIC NORTHWEST LABORATORIES

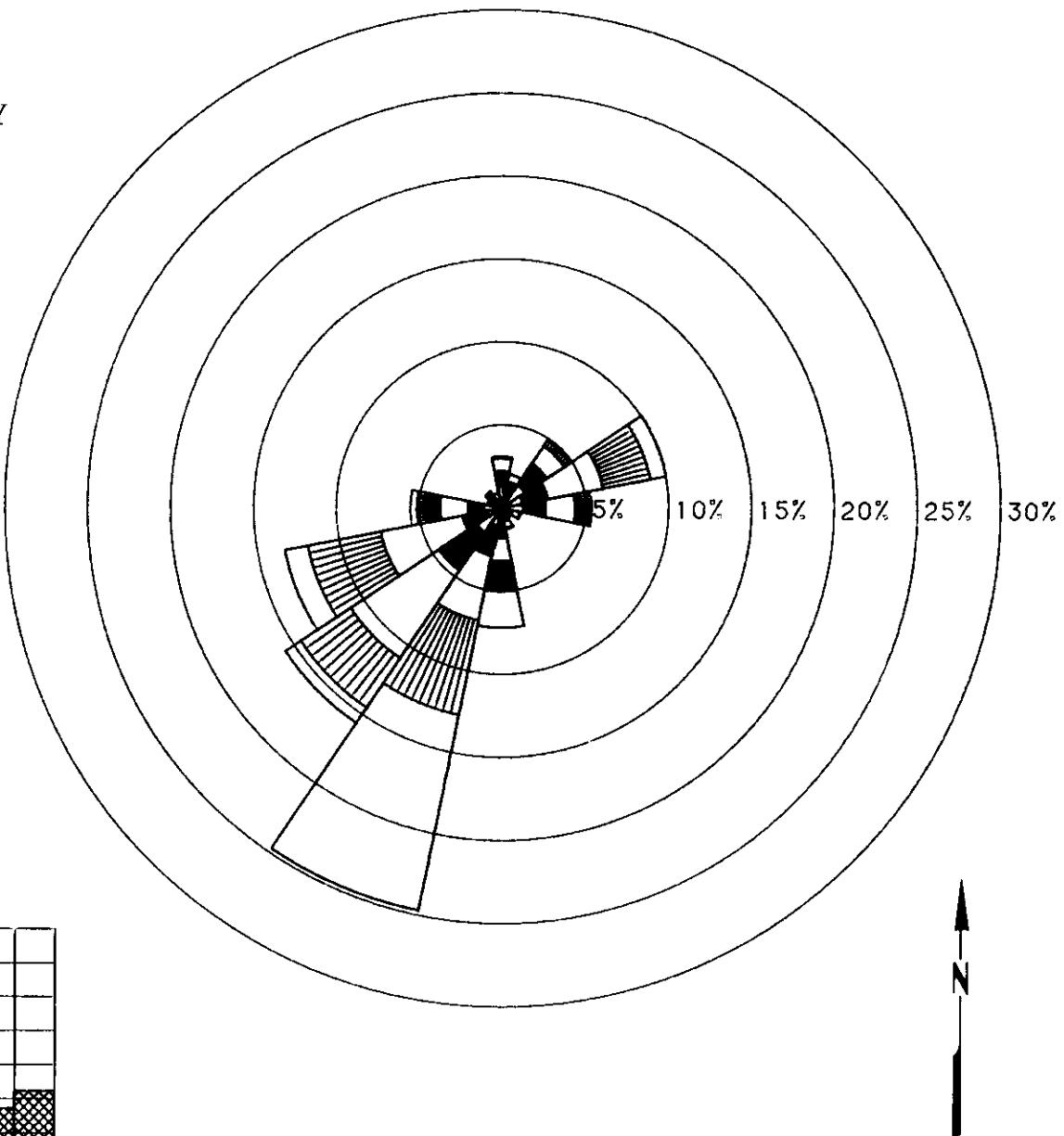
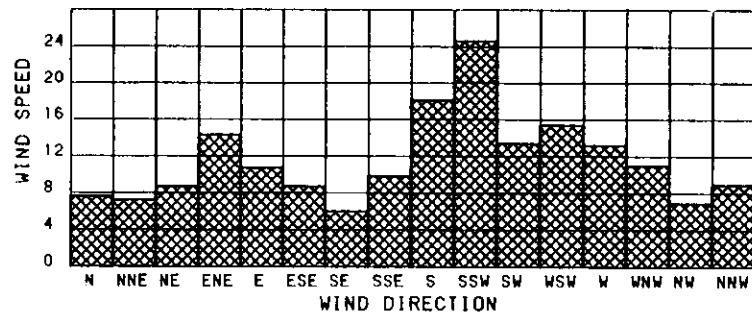
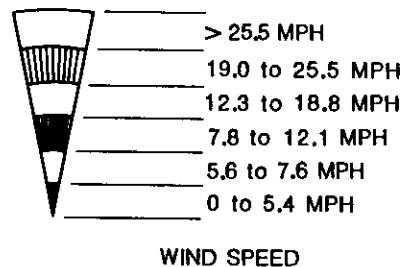
**Table IV - 130**  
**Annual Wind Rose Distribution**  
**PARK COUNTY - LIVINGSTON FAA AIRPORT**  
**01/01/48 - 07/04/53**

DIRECTION>	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL	<DIRECTION		
SPEED (MPH)																		SPEED (M/SEC)		
1.1- 3.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5- 1.4			
3.4- 5.4	0.2	0.1	0.3	0.2	0.2	0.0	0.1	0.1	0.1	0.1	0.2	0.1	0.2	0.0	0.1	0.0	2.0	1.5- 2.4	S	
5.6- 7.6	1.1	0.7	1.4	1.1	1.1	0.3	0.3	0.3	0.7	1.0	1.6	0.8	0.9	0.2	0.5	0.3	12.3	2.5- 3.4	P	
7.8- 9.8	0.5	0.4	0.8	0.7	0.6	0.2	0.1	0.2	0.5	0.8	1.1	0.6	0.5	0.1	0.2	0.1	7.4	3.5- 4.4	E	
10.1-12.1	0.4	0.4	0.7	0.8	0.7	0.2	0.1	0.2	0.5	1.0	1.6	0.9	0.4	0.1	0.2	0.1	8.3	4.5- 5.4	E	
12.3-14.3	0.5	0.3	0.8	1.6	1.0	0.2	0.1	0.2	0.7	1.8	3.4	2.3	0.8	0.1	0.2	0.2	14.2	5.5- 6.4	D	
14.5-16.6	0.2	0.1	0.3	0.8	0.4	0.1	0.0	0.1	0.3	1.0	1.5	1.2	0.4	0.1	0.0	0.1	6.6	6.5- 7.4		
16.8-18.8	0.1	0.1	0.2	1.0	0.4	0.1	0.0	0.1	0.4	1.2	1.5	1.5	0.5	0.1	0.0	0.1	7.3	7.5- 8.4	M	
19.0-21.0	0.1	0.0	0.3	1.4	0.5	0.1	0.0	0.1	0.7	2.3	2.1	2.3	0.7	0.1	0.0	0.0	10.7	8.5- 9.4	E	
I	21.3-23.3	0.0	0.0	0.1	1.0	0.2	0.0	0.0	0.0	0.7	2.2	1.1	1.5	0.5	0.1	0.0	0.0	7.4	9.5-10.4	T
L	23.5-25.5	0.0	0.0	0.0	0.5	0.1	0.0	0.0	0.0	0.4	1.3	0.4	0.7	0.2	0.0	0.0	0.0	3.6	10.5-11.4	E
E	25.7-27.7	0.0	0.0	0.0	0.5	0.1	0.0	0.0	0.0	0.4	1.5	0.4	0.6	0.2	0.0	0.0	0.0	3.7	11.5-12.4	R
S	28.0-30.0	0.0	0.0	0.0	0.3	0.1	0.0	0.0	0.0	0.4	1.9	0.3	0.4	0.1	0.0	0.0	0.0	3.5	12.5-13.4	S
/	30.2-32.2	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.3	1.3	0.2	0.2	0.1	0.0	0.0	0.0	2.2	13.5-14.4	/
H	32.4-34.4	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.2	1.0	0.1	0.1	0.0	0.0	0.0	0.0	1.5	14.5-15.4	S
O	34.7-36.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	1.4	0.1	0.1	0.0	0.0	0.0	0.0	1.8	15.5-16.4	E
U	36.9-38.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.7	16.5-17.4	C
R	39.1-41.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.8	17.5-18.4	O
	41.4-43.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.8	0.0	0.0	0.0	0.0	0.0	0.9	18.5-19.4	N	
	43.6-45.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.7	0.0	0.0	0.0	0.0	0.0	0.8	19.5-20.4	D	
	45.9-56.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.6	0.0	0.0	0.0	0.0	0.0	0.7	20.5-25.4		
	57.0-68.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	1.3	0.0	0.0	0.0	0.0	0.0	0.0	1.5	25.5-30.4	
	68.2-79.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.2	30.5-35.4	
	79.4-90.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	35.5-40.4	
	>90.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	>40.4		
	CALM																1.7	CALM		
AV SPD (MPH)	3.2	2.1	5.0	10.0	5.4	1.3	0.7	1.2	6.9	24.7	15.7	13.3	5.6	0.8	1.2	1.0	99.8	TOTAL		
AV SPD (M/S)	3.4	3.2	3.9	6.4	4.8	3.9	2.7	4.4	8.1	11.0	6.0	6.9	5.9	4.9	3.1	4.0	5.2	AV SPD (MPH)		
AV SPD (M/S)																		AV SPD (M/S)		

SOURCE: BATTELLE PACIFIC NORTHWEST LABORATORIES

**Figure IV - 14**  
**Annual Wind Rose**  
**LIVINGSTON FAA AIRPORT — PARK COUNTY**  
**(1948 - 1953)**

**KEY**



**Table IV - 131**  
**Coefficients of Weibull Distribution**  
**PARK COUNTY - LIVINGSTON FAA AIRPORT**  
**01/01/48 - 07/04/53**

MONTH	SCALE FACTOR (C) (M/SEC)	SHAPE FACTOR (K)
JANUARY	11.1560	1.7780
FEBRUARY	10.8990	1.8770
MARCH	8.6600	1.7670
APRIL	7.7930	2.0030
MAY	7.0240	2.0290
JUNE	6.9480	2.0310
JULY	5.8700	1.8800
AUGUST	6.3220	1.8550
SEPTEMBER	6.4940	2.0070
OCTOBER	8.1120	1.7030
NOVEMBER	10.2880	2.1010
DECEMBER	10.7900	1.9380
YEAR	8.4500	1.7660

SOURCE: BATTELLE PACIFIC NORTHWEST LABORATORIES